THE SPECIES COMPOSITION AND SEASONALITY OF AN ASSEMBLAGE OF TROPICAL AUSTRALIAN DUNG BEETLES (COLEOPTERA: SCARABAEIDAE: SCARABAEINAE)

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Abstract

Regular trapping of dung beetles was carried out over 14 months at an elevated rainforest site in northern Queensland. The fauna comprised 12 species and extended the known southern distribution limit for most of the species. The dung beetle fauna was highly seasonal: maximum values of both richness and abundance occurred in the wet season and minimum values in the dry season.

Introduction

Whilst the taxonomy and geographical distributions of native species of dung beetle are relatively well known (Matthews 1972, 1974, and 1976; Storey and Weir 1990), their ecology remains poorly understood (Doube *et al.* 1991). In particular, the seasonal changes which occur in native dung beetle assemblages have not been investigated, although there have been studies on seasonal abundance of particular species e.g. Tyndale-Biscoe *et al.* (1981). This study examines the species composition and seasonality of a highland native dung beetle community in tropical Australia.

Study site

The study area is located about 40 km north-west of Townsville at the southern end of the Paluma Range in a region called the Bluewater State Forest (19°10'S, 146°24'E). It also lies within the southern limit of the Wet Tropics World Heritage Area. The vegetation of the area corresponds to 'simple notophyll vine forest' (type 8), although there are scattered areas of woodland (type 16f) (Tracey 1982). The climate of the region is that of tropical highlands with the wet season usually occurring from December to April and drier months from May to November. Seven sampling sites with altitudes ranging from 700-800 m were selected within this area. The sites were at least 400 m apart, six within rainforest (type 8) and one in woodland (type 16f).

Methods

Two commonly used trapping methods were used to sample the dung beetle fauna. At each site one flight intercept trap (Peck and Davies 1980) was erected. The trap comprised a vertical, transparent plastic sheet (130 x 90 cm) underneath which were three rectangular containers. In addition, two pitfall traps with a 12 cm diameter were placed close to the intercept trap. Initially the traps were filled with diluted ethylene glycol as a preservative but this was changed to diluted formalin half way through the sampling period. The change in preservative was necessary because heavy rainfall reduced the effectiveness of the ethylene glycol.

The traps were installed on the 16.iii.1991 and cleared at 1-2 monthly

Table 1. Species list of the dung beetles caught and the abundance of each species over the sampling period.

	1991 APR	MAY	JUN	JUL	AUG	OCT	1991 NOV	1992 JAN	MAR	1992 MAY	TOTAL ABUND
SPECIES											
T. involucre Matthews	*	*	*	*	*	*	*	*	*	*	4373
L. palumensis Matthews	*	*	*	*	*	*	*	*	*	*	1212
T. aeneopiceum Matthews	*	*	*	*	*	*	*	*	*	*	1063
T. laeve (Castelnau)	*	*	*	*	*		*	*	*	*	327
L. ustulatus Lansberge	*	*	*		*	*	*	*	*	*	125
B. cornutus (Macleay)	*	*	*					*	*	*	112
0. brooksi Matthews	*							*	*	*	20
0. furcaticeps Masters								*	*	*	16
M. tropicus Lea	*							*		*	8
0. capella Kirby	*	*						*		*	4
A. pectoralis Matthews	*										1
C. subaenea Harold									*		1
TOTAL	10	7	6	4	5	4	5	9	10	10	

intervals until 3.v.1992. In total the traps were cleared 10 times on the following dates: 13.iv.91; 18.v.91; 29.vi.91; 27.vii.91; 30.viii.91; 4.x.91; 15.xi.91; 25.i.92; 7.iii.92 and 3.v.92. The contents of the traps were stored in 70% ethanol and all dung beetles (subfamily Scarabaeinae) were removed. Using the keys published by Matthews (1972, 1974 and 1976) the dung beetles were identified to species and counted. Beetles from the intercept and pitfall traps were pooled for the subsequent analysis. In order to standardise the sampling intervals, all abundance values were converted to the number of individuals per 30 sampling days (i.e. approximately monthly).

Results

Table 1 summarises the information gathered in this study. Twelve species of dung beetles were recorded at the study area. *Temnoplectron involucre* Matthews, *Lepanus palumensis* Matthews and *T. aeneopiceum* Matthews

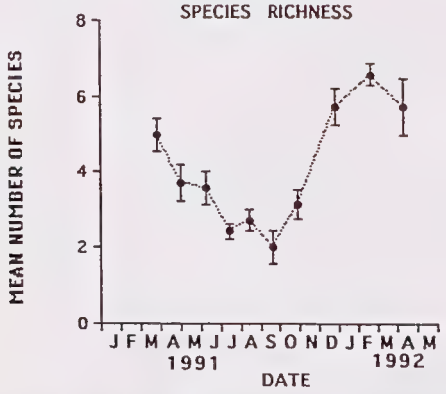

Fig. 1. Species richness of dung beetles over the sampling period (bars show ±1 S.E.).

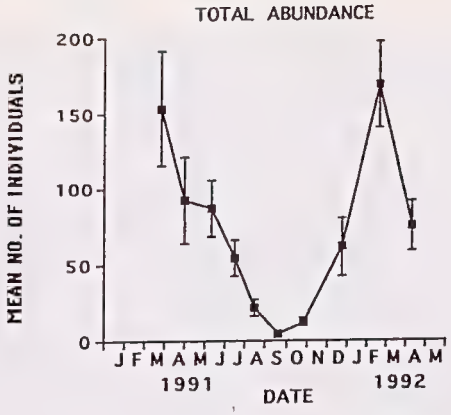

Fig. 2. Total abundance of dung beetles over the sampling period (bars show ±1 S.E.).

were abundant and occurred in all 10 of the samples. *T. laeve* (Castelnau), *L. ustulatus* Lansberge and *Boletoscapter cornutus* (Macleay) were common in the study area whilst the remaining species were relatively rare and were recorded only between January and May. *Onthophagus brooksi* Matthews, *Monoplistes tropicus* Lea, *Amphistomus pectoralis* Matthews and *Coptodactyla subaenea* Harold were the only species not captured at the woodland site.

Figs 1 and 2 describe the seasonality of the dung beetle assemblage. The maximum number of species occurred in the wet season (January to April) after which numbers declined steadily to a minimum in the dry season (June to September) (Fig. 1). A sharp increase in species richness occurred from October to December. The abundance of dung beetles followed a similar pattern (Fig. 2) with the least numbers trapped in September and the most in March. Fig. 3 shows the seasonal abundance for the six most common species. Whilst all six species are most abundant in the wet season it is apparent that the three most abundant species (*T. involucre*, *L. palumensis* and *T. aeneopiceum*) are still relatively abundant in June and July, reaching a minimum in September. In contrast the three less common species (*T. laeve*, *L. ustulatus* and *B. cornutus*) show a very rapid decline from a wet season maximum to a minimum in June or July.

Discussion

The results presented are the first published pattern of seasonality for a tropical Australian dung beetle assemblage. The passive nature of the traps probably resulted in the relatively simple assemblage of 12 species captured and the use of baited traps might have augmented the species list. Howden *et al.* (1991) found 18 species of dung beetle in the Wongabel State Forest (on the Atherton Tablelands, northern Queensland) using flight intercept traps

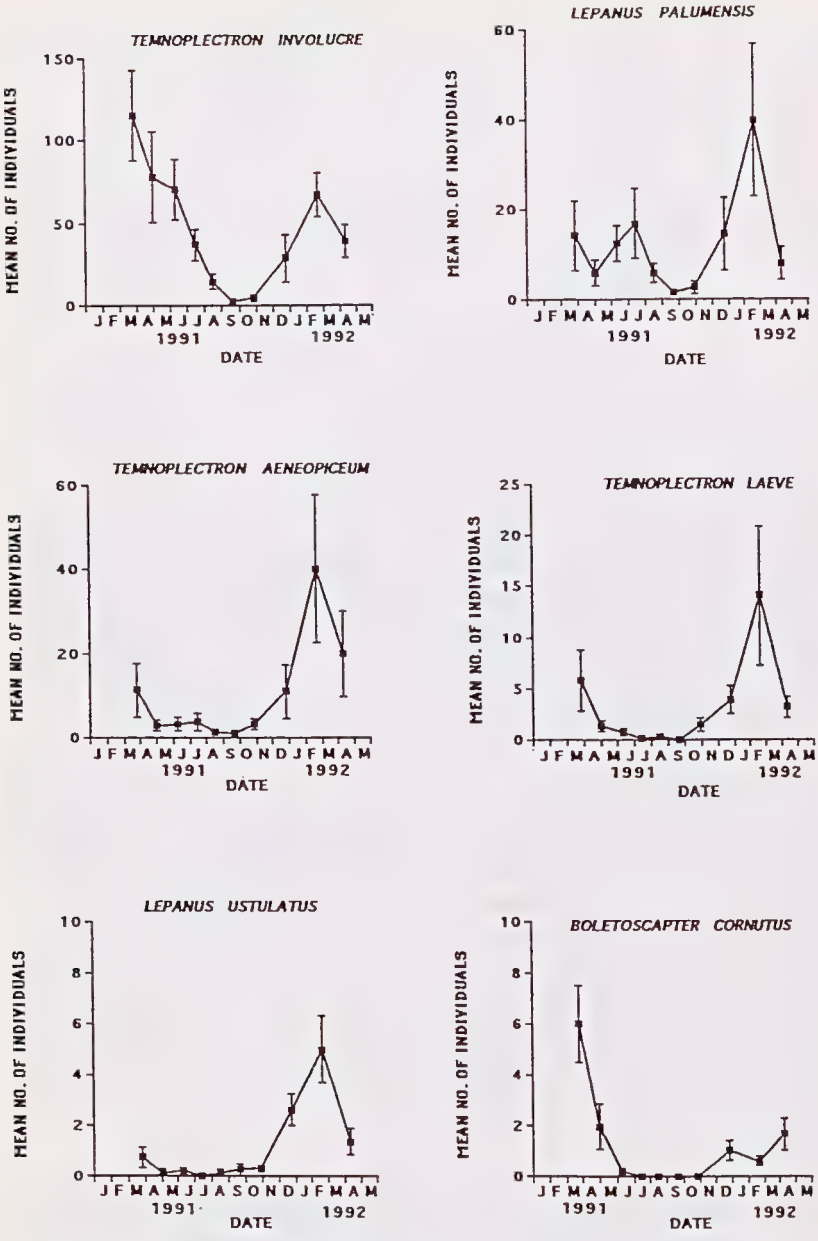

Fig. 3. Abundance of the six most abundant dung beetle species over the sampling period (bars show ±1 S.E.).

alone but recorded an additional four species using baited pitfall traps and light traps. In terms of their geographical distribution, the species fall into four groups. First there are the species for which the study site lies within their known distribution (*O. furcaticeps* Masters, *O. capella* Kirby and *T. laeve*) (Matthews 1972, 1974). Second are those species for which Paluma (some 30 km to the north of the study site) was previously the most southern record of their distribution (*C. subaenea*, *T. aeneopiceum* and *B. cornutus*) (Matthews 1974, 1976). Third are species for which Paluma was previously the only recorded locality (*O. brooksi* Matthews, *T. involucre*, *L. palumensis* and *A. pectoralis*) (Matthews 1972, 1974). Finally there are *M. tropicus* which had previously only been caught near Cairns (Matthews 1974) and *L. ustulatus* for which Matthews (1974) lists the northern most distribution as Eungella (west of Mackay). However in his list of material examined for the species, there is one record of *L. ustulatus* from Paluma (Matthews 1974).

The dung beetle species at this site showed a very simple seasonal pattern with both species richness and abundance reaching a maximum in the wet season and a minimum in the dry season. This result is in accordance with other studies of Australian species (Doube *et al.* 1991) but is perhaps surprising for a tropical study because vertebrate dung is available throughout the year and temperatures are generally high enough to sustain insect activity. Similar results have been obtained in other tropical regions with a distinct wet and dry season (e.g. Anderson and Coe 1974; Janzen 1983) and it has been suggested that soil moisture is a critical factor in determining dung beetle seasonality in these regions (Janzen 1983).

Acknowledgments

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